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ABSTRACT

A literature review examined the relationship of adults' verbal and mathematical literacy to employers' investments in training, employee wages, unemployment probabilities, unemployment duration, technological change, productivity, and economic growth. Most of the publications analyzed dealt with the United States. The analysis revealed that adults' basic literacy skills, which are usually acquired in school, do indeed affect the wealth of individuals and nations both directly and indirectly. The study also established that, although many workers receive some training from their employers, employers tend to invest most heavily in training their best educated/trained employees and concentrate training on craft, sales, managerial, and professional/technical skills. Employer-sponsored training has been found to complement rather than substitute for good foundation skills and to increase employees' productivity and earnings more than training in postsecondary institutions does. Employer-sponsored training also reduces job turnover, layoffs, and duration of periods of unemployment. Determining whether employers or economic sectors in a nation underinvest or overinvest in training depends on estimates of the rates of return to training; however, in the United States measurement of training costs is too poor to yield estimates of returns sufficiently narrow to serve as a basis for policy decisions. (Contains 33 references.) (MN)

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NATIONAL CENTER ON ADULT LITERACY

THE ROLE OF LITERACY IN THE WEALTH OF INDIVIDUALS AND NATIONS

Sue E. Berryman
The World Bank
Washington, DC

NCAL TECHNICAL REPORT TR94-13
SEPTEMBER 1994

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SEPTEMBER 1994

This work derived from a roundtable cosponsored by the Organisation for Economic Co-operation and Development (OECD) and the National Center on Adult Literacy (NCAL) at the University of Pennsylvania. NCAL is part of the Educational Research and Development Center Program (Grant No. R117Q00003) as administered by the Office of Educational Research and Improvement, U.S. Department of Education, in cooperation with the Departments of Health and Human Services and Labor. The findings and opinions expressed here do not necessarily reflect the position or policies of the OECD or the U.S. Department of Education.

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THE ROLE OF LITERACY IN THE WEALTH OF INDIVIDUALS AND NATIONS[1]

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Abstract

Adults' foundation skills, usually acquired in school, affect the wealth of individuals and nations, not just directly, but also indirectly through the often invisible and poorly measured human-capital-producing mechanism of employer-sponsored training. Employers train the trainable, building on the skills that their better educated employees bring to the labor market from school. Thus, employer-sponsored training depends on and is complementary to, not a substitute for, good foundation skills. Independent of employees' initial education, employer-sponsored training increases employees' productivity and thus their earnings more than training in post-secondary institutions; it decreases the incidence of quits, and, since most real wage gains result from being paid for being more productive, not from switching jobs, its effects on quits enhances wage growth; it decreases layoffs; and it decreases the duration of unemployment spells when they occur. Determining whether employers or economic sectors in a nation underinvest or overinvest in training depends on estimates of the rates of return to training, but in the United States, training costs are so poorly measured as to yield a range of estimated returns too wide to form a basis for policy advice.

INTRODUCTION

This report describes what is known about the relationships between adults' verbal and mathematical literacy, employers' investments in training, employee wages, unemployment probabilities, unemployment duration, technological change, productivity, and economic growth. As volatility becomes the defining characteristic of the economies that comprise the Organisation for Economic Co-operation and Development (OECD), the relationship between individuals' education and their lifetime economic outcomes changes. The effects of education on economic outcomes remain important but the effects become less direct and more indirect. Employers tend to invest training in the better educated, employer-sponsored training is an important means for employers and workers to adapt to change. Thus, under conditions of rapid change, employer-sponsored training increases and becomes more important than previously in determining individuals' economic outcomes.

This report is primarily based on data for the United States. Thus, it reflects the institutional arrangements that prevail among the governmental, employing, educational, and labor union sectors in this country. These arrangements differ substantially among the OECD countries, and one can, therefore, expect some of the relationships found among these variables for the United States to differ from those of other countries. For example, except in heavily unionized industries, such as the automobile industry, American employers can fire labor more easily and workers can change companies more easily than, for example, German, Japanese, or French employers and employees. This difference alone will affect employers' hiring standards and propensities to train. If employers have less ability to fire workers, their hiring expectations are for the long term. Thus, they will want to hire better educated workers who can learn new skills more easily than their less educated counterparts. Similarly, if employees are less apt to leave their companies, employers will be more likely to invest in worker retraining because they can anticipate capturing the benefits of that training for the firm.

The focus of this analysis is on employer-sponsored training because of what it reveals about the important direct and indirect effects of adults' levels of literacy on their own accumulated wealth and on that of nations. *Employer-sponsored training* is defined in this report as training available in or through the auspices of the firm. It does not necessarily mean that the training occurs within the company—training may occur in a college or postsecondary vocational training institution. Neither does it mean that the employer bears all of the cost of training.[3] In most cases, employers and employees share the cost, the employees' cost being paid in the form of wages during training that are lower than those they would receive if fully trained.[4]

Employer-sponsored training is largely invisible to the American policy community because, at least in the United States, it is badly and infrequently measured (Bartel, 1989; Mincer, in press). Some questions about employer-sponsored training are best resolved by analyzing data collected from employers. However, although case studies of firms' training investments exist, employer surveys of these investments are methodologically flawed, collect limited information, or survey only firms of a particular type (Bartel, 1989). Consequently, most of the available knowledge about corporate training

investments—the distribution of training among workers, determinants of these patterns, and their economic consequences—is based on cross-sectional or longitudinal surveys of individuals.[5] The sampling frames, response rates, and questions that these surveys ask could be improved, but even if this were done, they still could not yield information that can only be collected at the level of the firm. In addition, most of the available data, some of which is reported below, is between 6 and 10 years old—a serious weakness given that the period since the mid-1980s has seen dramatic changes in labor market conditions and therefore, potentially, in the intensity and distribution of employers' training investments. For example, firms that have reduced middle management and delegated supervisory functions to workers on the shop floor should increase their training of workers in what have been defined as lower skill occupations.

WHICH EMPLOYERS TRAIN, AND WHOM DO THEY TRAIN?

MANY WORKERS RECEIVE SOME TRAINING FROM THEIR EMPLOYERS

Even as of 1983, most workers stated that they needed training to get their current job. Given the increases in the human capital needs of the American and other OECD economies since the mid-1980s, the 1983 figures should seriously underestimate the current need for training to get jobs.

In 1983, 55% of the men and women in the total labor force said that they had needed training for their current job (Tan, 1989, Table 2.1).[6] Employers were a major source for this required training. In 1983, 42% of the men and 34% of the women in the labor force both needed training to get their current job and got some or all of it in formal company programs or informally on the job. Over a third—38% of men and 37% of women in 1983—reported getting training to improve their current job skills. Again, employers were a major source of this training. Twenty seven percent of the men and 28% of the women in the labor force both got training to improve their job skills and received some or all of it from the employer (Tan, 1989, Table 2.1).

EMPLOYERS INVEST HEAVILY IN TRAINING THEIR BEST EDUCATED AND TRAINED EMPLOYEES

Employers mainly train their best educated employees (Lillard & Tan, 1986; Mincer, in press; Tan, 1989). Employer training, therefore, accentuates the initial differences in educational attainment and achievement among employees, and the positive economic outcomes generated by employer-sponsored training accentuate the positive economic outcomes associated with those initial differences in educational attainment.[7]

For example, analyses of the National Longitudinal Survey of Young Men for two types of training (in-company programs and professional/technical training external to the company) show that from 1967 to 1980 only 45% of those who failed to complete high school, but 71% of high school completers and 79% of college graduates, received training in company-sponsored programs. The differences are even more striking for professional and technical training, which tends to be associated with higher wage work. Only 7% of the employees who did not graduate from high school received this type of training, compared with 27% of the high school graduates, 44% of those with some postsecondary education, and 56% of the employees who were college graduates (Tan, 1989, Table 2.8).

Analyses of men followed for two decades in the Panel Study of Income Dynamics (PSID) show that employees who are trained in previous jobs are also more likely than other new employees to be trained in subsequent jobs (Mincer, in press).

The positive relationship between school education and employer training investments can be interpreted in two, not mutually exclusive, ways. One interpretation is self-selection. The same abilities, motivations, and opportunities that predispose some individuals to invest more in schooling induce them to invest more heavily in training while in the labor market. The other interpretation is that training is not an alternative to schooling, but builds upon and is rendered more efficient by more schooling. Employer investments in and complaints about the need to invest in remedial education supports this second interpretation. The implication of this relationship is powerful: Company-sponsored training is complementary to, not a substitute for, school-based investments in verbal, mathematical, and problem-solving skills.

Low-Income Employees Are Poorly Educated and Receive Little Training From Employers

Lack of education and training is the single most distinguishing characteristic of the poor (e.g., Friedman, 1989). Lacking preparation for the workplace, they are less likely to be trained by their employers. For example, in one study conducted for the State of New York, only 2.6% of poor male workers and 2.3% of poor female workers reported receiving training from their employers (Kadamus, 1985).

Although some American employers run special programs for poorly educated and poor workers, it was estimated in 1988 that less than 1% of corporate training budgets was devoted to what former Xerox chairman David Kearns calls "product recall work for the public school system" (Berryman, 1988; Noyelle, 1989). The implication of employers' tendencies to invest training in the better educated is that people entering the workforce without sound academic and problem-solving skills will find it difficult to remedy their deficiencies on the job.

Employers Concentrate Training on Craft, Sales, Managerial, and Professional/Technical Skills

As of 1983, the occupations requiring the greatest amount of formal, company-sponsored training—either to get the job or to upgrade skills—were the craft, sales, managerial, and professional/technical occupations (Tan, 1989,

Table 2.3). Training in schools was more important than company training to get managerial, professional, and technical jobs, and, for women, clerical jobs. For professional and technical jobs, school training was also more important than company training for upgrading skills in the job. For craft occupations, company training was more important than training obtained in schools, both to get a job and to upgrade skills.

The limited training invested in the mid-1980s in the less skilled occupations, such as machine operators or service workers, reflected the routinized and narrow functions characteristic of these jobs. Since the early 1980s, American companies have been eliminating middle management positions and redefining lower skill jobs to include some of the supervisory functions previously performed by middle management. Companies have also been shifting from mass to flexible production, requiring a shift even on the shop floor from routinized to less routine work. These changes should combine to broaden the range of occupations in which employers will have to invest training. At the same time, studies indicate that as the responsibilities of previously lower skill jobs broaden and become less predictable, employers look for better educated workers (e.g., Bailey, 1988, 1989; Bartel & Lichtenberg, 1987; Berryman & Bailey, 1992). Thus, there is no reason to expect that the ongoing process of job redefinition in the American economy will weaken or eliminate the positive association between initial education and further training.

Employers Invest in Younger but Experienced Workers

Training of all sorts increases with experience on the current job—although at a decreasing rate (Mincer, 1989; Tan, 1989). The aggregate figures conceal important differences in training sources and types. Some kinds of training are concentrated in the first few years in the labor market; others are acquired more gradually over time. For male workers in the period 1967-80, training in business or technical schools outside the company was concentrated in the first five years of the career; in-company training increased steadily across the first decade of the career (Tan, 1989, Table 2.6). There are also differences in the timing of types of training. Professional and technical training occurs earlier in the career, whereas the probability of managerial training is low initially and increases over time, as might be expected if long promotion times are required to attain managerial rank (Tan, 1989, Table 2.6).

These patterns of training are consistent with life-cycle patterns of postschool training predicted by human capital theory and with the fact that educational institutions and the labor market are poorly articulated in the United States. Newer entrants to the labor market change jobs more frequently as they try to match career opportunities with their individual abilities and aspirations. American employers respond to this reality by investing less in employees during their first five years in the labor market because they are more apt to lose their investment in employee turnover. Employers invest less in older workers because they can recapture less of their investment during the employee's shorter remaining work life.

Employers in Sectors Where Employment is Growing Require Better Educated and Trained Employees

Financial services, public administration, and professional services, three rapidly growing sectors, employ workers with more formal education than agriculture, mining, wholesale trade, and manufacturing, sectors whose share of national employment has been falling or growing more slowly (Tan, 1989, Table 2.4; U.S. Congress, Office of Technology Assessment, 1988). This pattern reflects, in part, the effects of increased international trade and new technologies. The overall shift of employment from goods production to services means an increase in the level of education and employer training. Except for retail and nonprofessional services, the service sectors that are growing require more of one or both of these forms of human capital.

In-house training by companies is less prevalent in areas with cyclically sensitive economies (Bartel & Lichtenberg, 1987). Although large companies will tend to increase training for managerial employees during slack periods—training increases when the opportunity cost of employees' time is low—employee training is not typically countercyclical policy.

Small Firms Invest Less in Training Than Large Firms

Most studies report that in the United States small firms spend less on training than large firms (Bartel, 1989; Lusterman, 1985; Lynch, 1994). This may reflect the fact that they are less likely to have a separate personnel department with formal company training procedures and, therefore, are less apt to count training occurrences. Because employees in small firms must often learn a wider variety of skills, and because small firms usually report hiring slightly less educated employees than large firms, small firms would appear to have a greater need for training.

Employer-Sponsored Training Raises Employees' Wages and Improves Their Employability More Than Other Forms of Training

Workers' foundation skills, usually school-acquired, affect employers' training investments in them, which in turn increase employees' earnings, make it easier for them to find and keep work, and raise their productivity. As the importance of human capital to the economy grows, the earnings differentials between employees with education and training and those without widen.

Employer-Sponsored Training Raises Wages and Productivity, and the Effect Endures for Many Years

Company-sponsored training appears to raise earnings more than training in postsecondary institutions (Lillard & Tan, 1986, Table 4.5; Mincer, in press). Employers can invest more effectively in their workforces because they know better than postsecondary institutions which types of skills are needed on the job. The more general training offered in the classroom cannot be as job specific. Employers also know which employees are best suited for training—they have, in most instances, monitored their performances for several years.

Trainees' wages rise most rapidly during the training period (4-5%), but the impact of training on wages endures for over 10 years (Mincer, 1987). Training

increases wages most for young workers. For those with less than 12 years of work experience, trained workers enjoy wages that at any point in time during the ten years are on average 9.5% higher than the wages of untrained workers. For those with more than 12 years of work experience, trained workers receive wages that on average are 3.5% higher than the wages of untrained workers (Mincer, 1989; in press).[8] The smaller average wage payoff for more experienced workers probably reflects the fact that older workers already have more skills by virtue of greater job experience, so that training raises their productivity less than that of inexperienced workers. Thus, the decline in job training intensity with age and the lesser payoff to training that occurs combine to help explain the repeatedly observed pattern of decelerating wage growth as workers age.

Rosen (1982), using 1976 PSID data, found similar wage results for two groups—those who had received training during the year, and those who had not. In the former group, the wage profiles were steep and concave; in the latter, flat.

Trained Workers Are Less Likely to Quit Their Jobs

Overall, holding constant on levels of tenure, marital status, education, and union status, workers who receive training are less likely to leave the company that trained them (Lillard & Tan, 1986; Lynch, 1988; Mincer, 1987). Workers who move less are more likely to receive training from their employers, and workers who exhibited prior mobility exhibit less mobility once they receive training. Trained workers also change jobs within their company less often than untrained workers.

Training, not job switching, is the quickest way to increase earnings. For the average employee, less than 15% of real wage gains over time results from changing jobs; 85% comes from being paid more for being more productive (Mincer, 1989).

Young workers, as they seek suitable careers, are equally mobile with or without training. Among younger workers, mobility does not appear to reduce the premium they earn from participating in training, indicating that their company training is valued by other employers. But as young workers acquire training, they become less likely to move (Mincer, in press).

Well-Educated and Trained Workers Are Less Likely to Be Laid Off and Experience Shorter Unemployment Spells if They Are

Workers with less than 12 years of schooling are 170% more likely to suffer unemployment, and they experience spells of unemployment 30% longer than workers with 16 or more years of schooling (Mincer, 1987). Educated workers are more likely to search for a new job while still employed, thus reducing search costs; educated workers acquire and process information more efficiently than less educated workers; and employers and employees both search more intensively to fill more skilled slots.

Training further reduces both the probability of experiencing unemployment and its duration (Mincer, 1989). Controlling for differences in education, people with employer-sponsored training experienced an average of 7.7 weeks of unemployment in 1980, while those with none

experienced 9.0 weeks. People with no occupational training, on-the-job or in school, experienced an average of 10.2 weeks. The reduced likelihood of unemployment for those with company training is noticeable for a period of 12 years after training is completed.

TECHNOLOGICAL CHANGE, ECONOMIC GROWTH, AND TRAINING

Nations have feared technology as a destroyer of jobs. In the United States in the 1960s, the prospect of computerized production led many to predict reduced employment and "de-skilled" jobs (e.g., Ellul, 1967). But technology has not reduced overall employment. After a century of unprecedented technological progress, a higher share of the American population is employed today and is earning more than at any time in its history (U.S. Department of Commerce, various years). At the same time, the overall influence of technology on employers' demands for skills masks problems of adjusting to increases in the pace of technological change.

Historically, technological advances have raised the overall skill level of the workforce and have replaced low-skill jobs with higher skill jobs. Specifically, technological progress has changed the labor market in three ways: (a) reduced the number of jobs in goods-producing activities relative to services, (b) increased the relative importance of higher skill occupations within sectors, and (c) broadened skill requirements within occupations.

Studies indicate that recent technological change is biased toward human capital (Bartel & Lichtenberg, 1987; Lillard & Tan, 1986; Mincer, 1989; in press). In other words, a more rapid pace of technological change in a sector generates a greater demand for more educated workers in that sector and for the continuous retraining of these workers. Specifically, in industries with rapid technological change:

- The share of educated workers in the sector increases without a simultaneous increase in training, at least initially. As the pace of change increases, employers first hire people with more general education (Bartel & Lichtenberg, 1987; Mincer, 1989). New technologies test the training and flexibility of workers, and education provides general human capital that equips people to cope with change more effectively (Carraher, Carraher, & Schliemann 1985; Resnick, 1987; Schultz, 1975). More educated workers, particularly those with recent education, appear better able to deal with technical problems as well as with the unstable environment created by rapid technological change (Bartel & Lichtenberg, 1987)[9]. Thus, within occupations, the average educational attainment of employees in high-productivity-growth industries increases (Gill, 1989).

- Employers' initial responses of hiring better educated workers are followed by hiring less educated workers and increasing in-house training. Hiring better educated workers is expensive: Education provides general skills that command higher wages, even though employers may need only a part of those skills. Therefore, when new technologies become routinized, employers can be more specific in the skills that they hire. At this point, firms expand in-house training and hire fewer well-educated and, therefore, expensive workers.
- In the early stages of technological innovation in industries, average wages for less educated workers do not grow as fast as for less educated workers in industries with lower productivity growth. For the better educated, wages grow faster even in the early stages of technological innovation than in industries with lower productivity growth. However, as the technology matures and training increases, wages in high-productivity-growth sectors grow faster than in other industries even for the less educated (Mincer, 1989).
- Well-educated, especially younger, workers are more likely to move into the higher wage, high-productivity-growth sectors (Mincer, 1989).
- Wage profiles are steeper in sectors with higher productivity growth since the returns to training and experience are greater.
- In higher productivity growth sectors, turnover rates increase slightly in the short run. However, in the longer run, despite the rapid pace with which skills become obsolete in such industries, turnover is lower than in sectors where productivity is growing more slowly. This indicates that employees must be acquiring extensive skills specific to the firm as well as skills specific to the technology. It also suggests that employers are willing to retrain their employees often and that they assume a major share of the training costs.
- In industries with rapid technological change, worker separation rates increase slightly in the short run. They decline in the long run, probably because employer-sponsored training intensifies (Mincer, 1993).
- Those workers who do quit jobs in higher productivity growth industries are less likely than those in other sectors to experience unemployment, and, if they do, are unemployed more briefly (Mincer, 1989).

WHAT IS THE MAGNITUDE OF EMPLOYER-SPONSORED TRAINING?

In 1985, annual investments in employer-sponsored training, both formal and informal or on-the-job, in the United States accounted for about 40% of America's annual human capital investments, totaling about $150 billion (or about 4% of GNP).[10] These investments were about half as large as investments in plant and equipment. Public investments in primary and secondary education in 1985 were about $170 billion and in postsecondary education and training about $100 billion. It should be noted that the cost of wages and salaries is included in the investment estimates, whereas in the case of secondary and postsecondary education, the students' foregone wages are not included in the investment figure. Each year, these investments extend the skills and education of the workforce and add more to national product than America's investments in capital equipment (Denison, 1986).

Knowing whether employers invest too much or too little in training their employees is vital for determining the appropriateness of a country's public policy on training. The best guide to the appropriateness of employers' investments is the rate of return earned by those investments. The rate of return expresses the increase in productivity of employees as a percentage of the initial costs of the training. If returns were high relative to other types of investments, new equipment, expanded plant, larger inventories, for example, we might conclude that employers are underinvesting in training, because they could increase output by reducing other investments and investing more in training. If the returns to training were relatively low, employers could gain by investing less in training and instead expanding other types of investments.

Unfortunately, the rate of return to employer-sponsored training in the United States cannot be estimated well because measures of the costs of the investment are poor. The largest and most elusive cost element is employees' foregone productivity while engaged in training. Empirical estimates of the average return range from 4% to 25% (Mincer, 1989, Table 13); available data do not allow a most likely estimate within this range. Therefore, statistically the firms or industries that systematically underinvest in training or types of employees that might profitably be the subject of additional training cannot be well identified.

Even if the average rate of return for those who receive company training could be better estimated, the average rate of return does not indicate the benefits—the increased productivity—that would result from expanding investments in training. Because human capital is subject to the same diminishing returns to scale that affect all factors of production, increased investments beyond a certain level will yield rates of return below the average rates.

An association between higher rates of training and higher rates of economic growth also does not necessarily imply that increasing training will increase economic growth. Training must be connected to new economic opportunities

to yield productivity and economic growth payoffs. These new economic opportunities may be new technologies, a reorganization of work within the company to increase its efficiency, new markets, or new products. Training in the absence of new economic opportunities will have no economic impact; the basic challenge lies in creating these opportunities.

SUMMARY

Employer-sponsored training reinforces rather than reduces the differences in educational attainment among new employees. Well-educated people are the most likely to find employment and to receive training from their employers. Once trained, their greater productivity earns them more; they switch jobs less frequently, thus reaping the wage gains associated with training for the job and firm; and they are rarely unemployed. If they change jobs, they find another more easily and are more likely to receive further training from their new employers. They have more access to the higher wage jobs characteristic of high-productivity-growth industries. Those who start their careers lacking sound academic and problem-solving skills fall further and further behind.

In other words, the level of the employee's human capital, as measured by years of schooling, affects the probability of receiving employer-sponsored training and its benefits. It might be concluded that the policy implication of this story is to increase everyone's level of education. This is dubious logic: [If X, then Y] does not logically imply [If Y, then X]. More important, it is a financially unsustainable and unnecessarily blunt policy instrument. Even when noneducational factors that affect employer-sponsored training, such as firm size, industry, or occupation, are controlled, years of education and receiving employer-sponsored training are not perfectly related. Not everyone with more years of education receives employer-sponsored training, nor do all those with fewer years of education not receive it.

The key issue is: What skills tend to trigger employer training investments? This question cannot now be answered, because there are no measures of employee skills, such as literacy competencies, as opposed to years of school completed. If employees with certain skills, regardless of years of education, have higher probabilities of receiving employer-sponsored training, the policy option of focusing on the development of those skills emerges. The argument is analogous to targeted subsidies to help the poor, as opposed to blanket subsidies that also happen to apply to the poor.

ENDNOTES

1 This report updates the syntheses of the analyses of six background papers and peer reviews commissioned for the *Conference on Employer-Sponsored Training*. The conference was sponsored by the Institute on Education and the Economy, Teachers College, Columbia University. The synthesis paper was by R. Vaughan and S. Berryman (1989), and the background papers by T. Bailey (1989), J. Mincer (1989), A. Bartel (1989), T. Noyelle (1989), H. Tan (1989), and R. Vaughan (1989). Peer reviewers included A. Pascal, The RAND Corporation; R. Ehrenberg, Cornell University; R. Willis, University of Chicago; D. Stern, University of California at Berkeley; M. Hashimoto, Ohio State University; and G. Burtless, The Brookings Institution.

2 This report represents the views of the author only, not necessarily those of the World Bank, any of its affiliated institutions, or members of its Board of Executive Directors, or the countries they represent.

3 In the extreme case, the employer may bear none of the cost. In this case, the employer acts as a proprietary training institution that sells training to those, including employees, who wish to purchase it.

4 Economic theory predicts that the specificity of the training determines who pays. To the extent that the training is specific, or restricted, to the firm's operations, the employer pays all or most of the cost. To the extent that it creates skills that can be used in companies other than the employer's company, the employee pays a larger share (Becker, 1964).

5 The micro-data sets include the Current Population Survey, the four National Longitudinal Survey age cohorts (young men, young women, women, and mature men), the Panel Survey of Income Dynamics (PSID), the Employment Opportunities Pilot Projects (EEOP), the longitudinal High School Class of 1972, the High School and Beyond longitudinal surveys, and the Survey of Income and Program Participation (SIPP).

6 These data are from the January 1983, *Current Population Survey*. The numbers refer to jobs entered since 1959. Thus, the training needed to enter them could therefore have been obtained some years ago or as recently as in the previous month.

7 Tuijnman (1992) reports evidence on the continuity between initial and post-initial training and on the economic returns to human capital accumulation for samples of adults in Colombia, Norway, the Netherlands, Sweden, and the United States.

8 This estimate is similar to the estimate of 7.5% per year for the first two years of work in Barron, Black, and Loewenstein (1986).

9 Two industries undergoing massive change are textiles and commercial banking; in both cases, employers find they need better educated workers. The manager of a large apparel plant complained, "These workers can't do anything they haven't done before, and my equipment is changing too fast to allow me to show them how to do everything" (Bailey, 1989). Commercial banks in Japan, Germany, France, and the United States sharply upgraded the educational attainment of their new hires between 1976-77 and 1985-86. A German bank, for example, shifted from 85% of its new employees with less than twelve years schooling to 85% with 12 or more years (Noyelle, 1989).

10 Carnevale (1984) places the range at $66 to $175 billion, excluding the cost of employees' foregone earnings. Mincer (1989, Table 14) estimates a range of $105 to $210 billion, including employees' contributions in the form of lower wages. The 1985 GNP figure comes from the U.S. Congress, Office of Technology Assessment (1988).

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